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(72) Inventors: STANDKE, Randolph, E.; 13283 Boomer Court, San Diego, CA 92129 (US). BURKE, Joseph, P.; 3478 Corte Clarita, Carlsbad, CA 92009 (US). HEIDMANN, Peter; 3354 Avenida Nieve, Carlsbad, CA 92009 (US).

(74) Agents: WADSWORTH, Philip, R. et al.; Qualcomm Incorporated, 5775 Morehouse Drive, San Diego, CA 92121-1714 (US).

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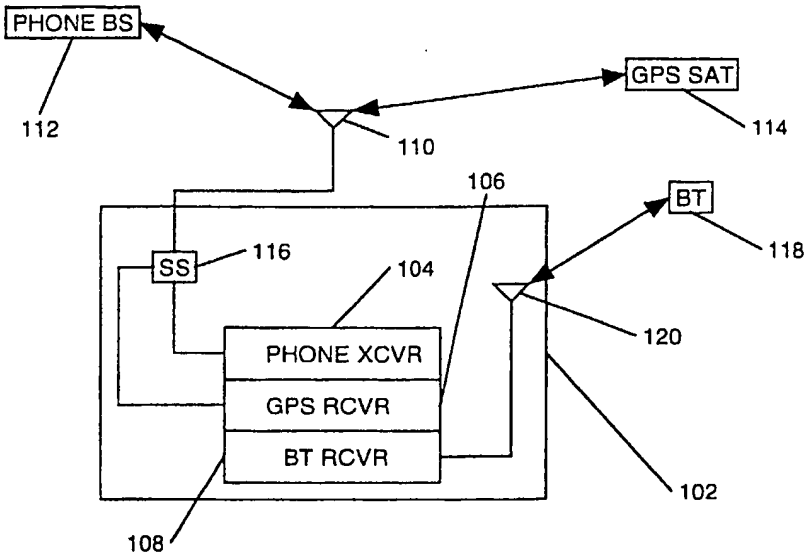
(54) Title: MULTIPLE BAND WIRELESS TELEPHONE WITH MULTIPLE ANTENNAS



(57) Abstract: A wireless telephone (102) includes a telephone transceiver (104), GPS receiver (106), and Bluetooth transceiver (108). The telephone antenna (110) is external, and the Bluetooth antenna (120) is internal. The GPS receiver (106) may be driven by its own internal antenna (326), or via a signal separator (116), (216), by either of the other antennas (110), (120).

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MULTIPLE BAND WIRELESS TELEPHONE WITH MULTIPLE ANTENNAS

BACKGROUND OF THE INVENTION

Technical Field

[1001] This invention relates to wireless telephones, and has particular relation to antenna architecture for multiple band wireless telephones.

Background Art

[1002] Wireless telephones have long had to operate in multiple frequency bands. The older cellular telephones operate at 800 MHz, while the more modern PCS (Personal Communication System) telephones operate at 1900 MHz. This could be done with a single antenna, operating as a quarter-wavelength antenna in the first band and as a half-wavelength band in the second. As additional features become available, however, additional antennas must be used. This is undesirable, since it adds to the weight and bulk of what is intended to be a lightweight, compact, and (most importantly) portable product -- a wireless telephone.

BRIEF DISCLOSURE OF THE INVENTION

[1003] Applicants have overcome the limitations of the prior art, at least where the additional features are GPS and Bluetooth.

[1004] GPS is the Global Positioning System. A ground-based receiver receives precisely timed signals from several satellites. Each satellite has a precisely known position, a code for which is also included in the signal. By noting the time (and the differences in time) at which each signal is received, the receiver can calculate its own position. GPS operates at 1575 MHz.

[1005] Bluetooth is a project of the Bluetooth Special Interest Group. Its website as of the filing date of the application, at http://www.bluetooth.com, is

without cables. It does so by using a low-power, short-range (10-100 meter) radio link, operating at 2400-2483 MHz.

[1006] The present invention provides wireless telephone, GPS, and Bluetooth capabilities in a single device with a single external antenna. Three embodiments are shown.

[1007] In the first embodiment, the telephone is designed to operate in only one telephone band. The external antenna is tuned for a multi-band response to access both telephone and GPS. A diplexer or electronic switch separates the telephone and GPS signals. An internal antenna is used for Bluetooth.

[1008] In the second embodiment, the telephone is designed to work in two telephone bands. The external antenna is used for both telephone bands. A single internal antenna is used for GPS and Bluetooth, with a similar diplexer or electronic switch.

[1009] The third embodiment is similar to the second, but uses two internal antennas, one for GPS and the other for Bluetooth. The diplexer or electronic switch is omitted.

BRIEF DESCRIPTION OF THE DRAWINGS

[1010] FIG. 1 is a block diagram of the first embodiment of the present invention.

[1011] FIG. 2 is a block diagram of the second embodiment of the present invention.

[1012] FIG. 3 is a block diagram of the third embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[1013] FIG. 1 is a block diagram of the first embodiment of the present invention. A wireless telephone (102) has a telephone transceiver (104), GPS receiver (106), and Bluetooth receiver (108). An external antenna (110) receives telephone signals from a remote telephone base station (112), and also receives GPS signals from a constellation of remote GPS satellites (114). These signals

The signal separator separates the telephone signals and the GPS signals, and applies the telephone signals to the telephone transceiver (104) and the GPS signals to the GPS receiver (106). A remote Bluetooth device (118) sends signals to an internal Bluetooth antenna (120), which applies the Bluetooth signals to the Bluetooth receiver (108).

[1014] FIG. 2 is a block diagram of the second embodiment of the present invention. FIG. 2 is generally the same a FIG. 1, with two exceptions.

[1015] First, the external antenna (110) of FIG. 1 has become external antenna (210), since it has been optimized to receive telephone signals on two bands rather than on one band. Signals on a first band are received from a first remote base station (222), and signals on a second band are received from a second remote base station (224). The two base stations may be co-located, and may even share an antenna, but are considered to be separate since they operate on different frequency bands. The single-band telephone transceiver (104) of FIG. 1 is changed to become dual-band telephone transceiver (204) of FIG. 2. Dual-band telephone transceivers sharing a common antenna are known in the art.

[1016] Second, the signal separator (116) of FIG. 1 has become signal separator (216) of FIG. 2, since it separates GPS and Bluetooth signals rather than GPS and telephone signals. Internal antenna (120) of FIG. 1 has become internal antenna (220) of FIG. 2, since it has been optimized to receive both GPS and Bluetooth signals, rather than just Bluetooth signals. The signal separator (216) receives Bluetooth signals and GPS signals from the internal GPS antenna (220) and separates the two signals. It then applies the Bluetooth signals to the Bluetooth transceiver (108) and the GPS signals to the GPS receiver (106).

[1017] FIG. 3 is a block diagram of the third embodiment of the present invention. FIG. 3 is generally the same a FIG. 2, with one exception. The signal separator (216) has been removed, and a separate, internal, GPS antenna (326) has been added, which directly applies GPS signals to the GPS receiver. The Bluetooth antenna (120) applies Bluetooth signals to the Bluetooth transceiver (108), as in FIG. 1.

Industrial Application

[1018] This invention is capable of exploitation in industry, and can be made and used, whenever is it desired to provide a wireless telephone with GPS and

method shown herein, taken separate and apart from one another, may be entirely conventional, it being their combination that is claimed as the invention.

[1019] While various modes of apparatus and method have been described, the true spirit and scope of the invention are not limited thereto, but are limited only by the following claims and their equivalents, and such are claimed as the invention.

CLAIMS

1) A wireless telephone, wherein:

a) the telephone includes:

i) a telephone transceiver;

ii) an external antenna connected to the telephone transceiver; and

iii) a Global Positioning System (GPS) receiver and antenna; and

b) the telephone is ***characterized in that*** the telephone also includes a Bluetooth transceiver and internal antenna.

2) The wireless telephone of claim 1, ***further characterized in that*** the telephone further includes a signal separator connected to:

a) receive telephone signals and GPS signals from the external antenna;

b) separate the telephone signals and the GPS signals;

c) apply the telephone signals to the telephone transceiver; and

d) apply the GPS signals to the GPS receiver.

3) The wireless telephone of claim 1, ***further characterized in that*** the telephone further includes a signal separator connected to:

a) receive Bluetooth signals and GPS signals from the internal GPS antenna;

b) separate the Bluetooth signals and the GPS signals;

c) apply the Bluetooth signals to the Bluetooth transceiver; and

d) apply the GPS signals to the GPS receiver.

4) The wireless telephone of claim 1, ***further characterized in that*** the GPS antenna telephone is internal and separate from the Bluetooth antenna.

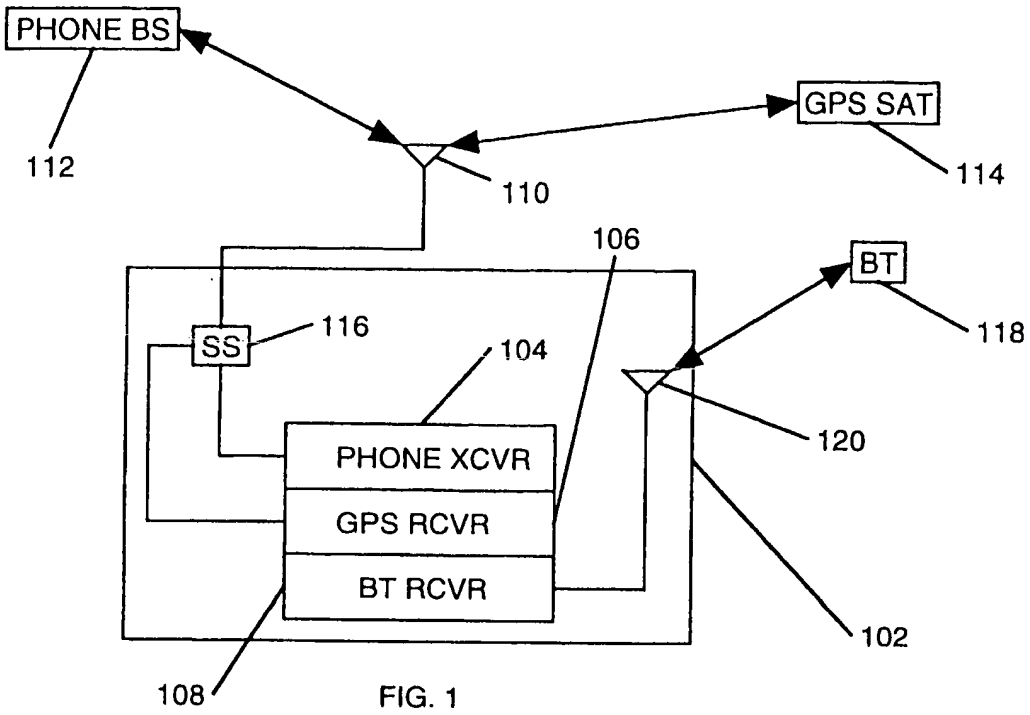

FIG. 1

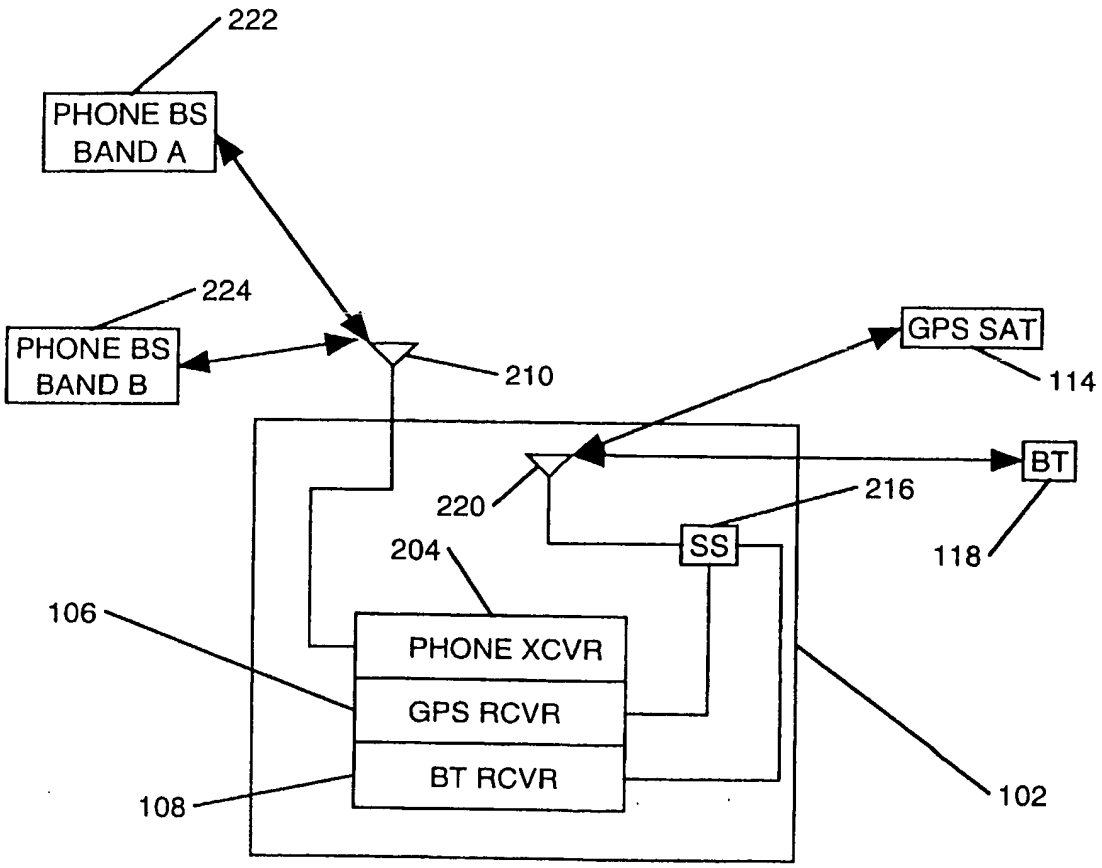

FIG. 2

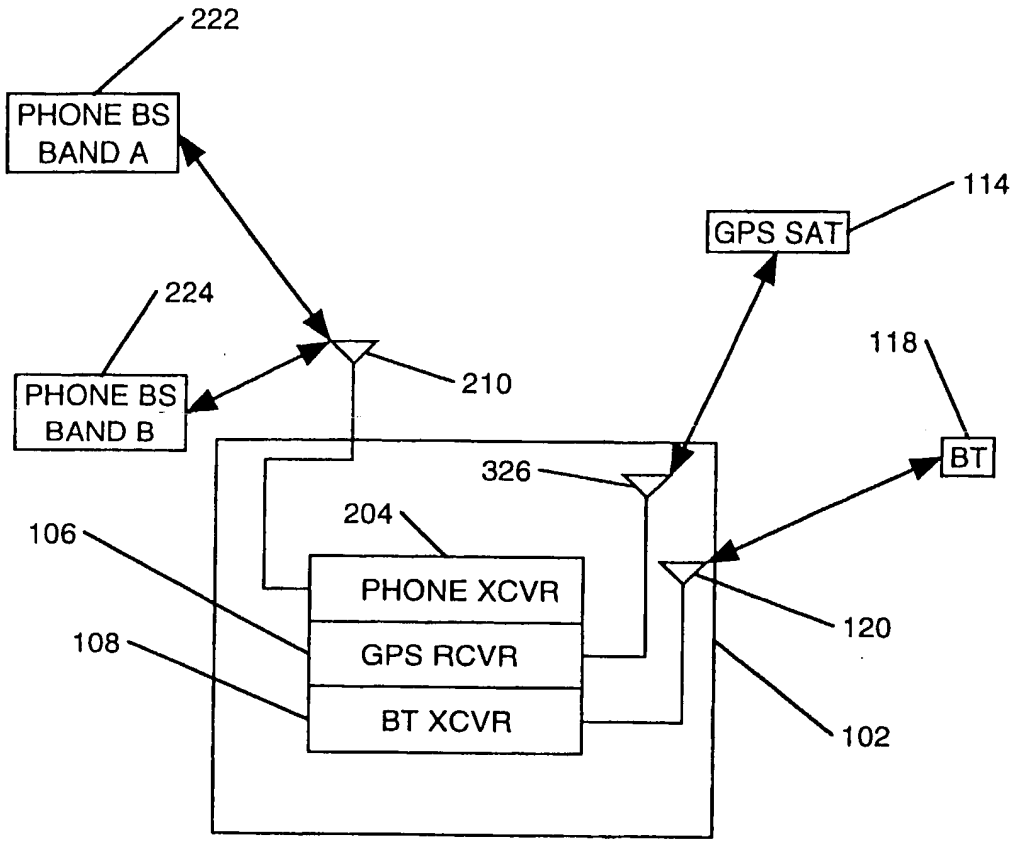

FIG. 3

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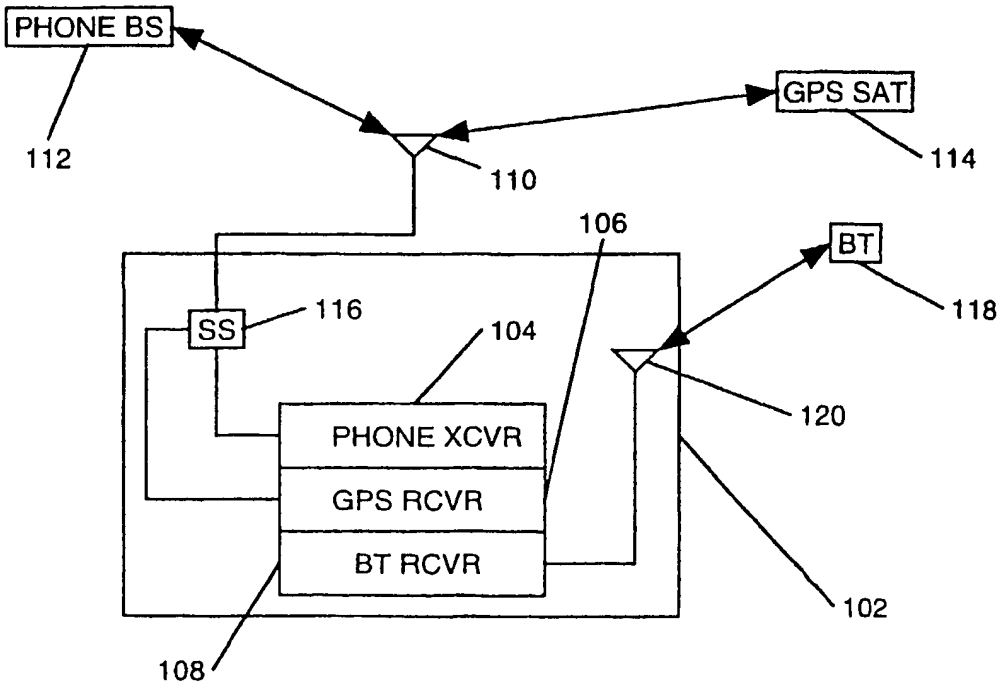

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INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04B1/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H04B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data, PAJ, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 918 183 A (JANKY JAMES M ET AL) 29 June 1999 (1999-06-29) abstract figures 23,24	1-4
A	BURSKY D: "MINIATURE EMBEDDABLE ANTENNA TARGETS BLUETOOTH SYSTEMS, WEIGHS IN AT 1 G" ELECTRONIC DESIGN, PENTON PUBLISHING, CLEVELAND, OH, US, vol. 47, no. 22, 28 October 1999 (1999-10-28), page 28 XP000928226 ISSN: 0013-4872 figure 1	1-4

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
21 September 2001	28/09/2001

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Lazaridis, P

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Form PCT/ISA/210 (second sheet) (July 1992)

INTER .TIONAL SEARCH REPORT

Information on patent family members

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5918183 A	29-06-1999	WO 9609941 A1	04-04-1996

Form PCT/ISA/210 (patent family annex) (July 1992)